J Ped Surg Case Reports 2 (2014) 294–296

Contents lists available at ScienceDirect

Journal of Pediatric Surgery CASE REPORTS

journal homepage: www.jpscasereports.com

Conservative treatment of tracheal injuries☆

Mathis Steindor [a,*], Antje Schuster [a], Thomas Hoehn [a], Ertan Mayatepek [a], Mariana Santos [b], Sebastian Angenendt [b], Dirk Klee [c], Dirk Schramm [a]

[a] Department of General Pediatrics, Neonatology and Pediatric Cardiology, University Children's Hospital, Heinrich-Heine University, Duesseldorf, Germany
[b] Department of General, Visceral and Pediatric Surgery, Heinrich Heine University, Duesseldorf, Germany
[c] Department of Diagnostic and Interventional Radiology, Heinrich-Heine University, Duesseldorf, Germany

ARTICLE INFO

Article history:
Received 28 April 2014
Received in revised form
19 May 2014
Accepted 20 May 2014

Key words:
Airway trauma
Soft tissue emphysema
Airway management

ABSTRACT

Tracheal wall injuries are life-threatening and require immediate medical attention. A lack of empirical data has led to an absence of reliable recommendations, which tracheal injuries need surgical treatment and in which a conservative approach is to be favored. We present 2 cases of severe traumatic tracheal wall injuries in pediatric patients, aged 14 and 7 years. Many authors would have considered surgical repair treatment of choice for either one. However, both patients were successfully treated by bridging the tracheal defects by an endotracheal tube and supportive care. Airway healing was monitored by repeated tracheoscopy. In conclusion, conservative treatment of traumatic tracheal injuries is feasible in pediatric patients.

Tracheal wall injuries after blunt or penetrating trauma are life-threatening events. The majority of affected patients die before admission [1,2]. Those who reach the emergency room need fast treatment to maintain or establish adequate ventilation. Recently this surgical stronghold is engaged by reports of favorable outcome of conservative approaches [3,4]. These clinicians try to avoid perioperative mortality and postoperative complications such as stenosis, infection, nerve palsies, leakage and fistulas [1,2,5]. However, rareness of tracheal wall lacerations even in large trauma centers causes a lack of evidence to support either position. Prospective studies are missing and recommendations are based on case-reports and retrospective studies on small cohorts, in which most injuries are iatrogenic and result from intubation or percutaneous dilatational tracheostomy. We report two cases of conservatively treated traumatic tracheal lacerations in two pediatric patients.

1. Case 1

A 14-year-old male stumbled while trying to catch a bus carrying a "butterfly" knife for unknown reasons. The knife penetrated his left anterior cervical region pointing in downwards right direction. The patient arrived at the emergency room in a stable cardiorespiratory state with the knife still about 4 cm deep in the soft tissue of the anterior neck (Fig. 1A). Initial tracheoscopy during intubation showed a tracheal laceration on the left side of the tracheal wall without signs of active air leakage. The endotracheal tube was placed distal to the laceration for controlled ventilation and the knife was removed surgically. Surgical site showed a penetration channel of about 10 cm length affecting subcutis, trachea, mediastinum and right pleural dome without signs of relevant nerve or vascular damage. Postoperative chest-X-ray demonstrated bilateral cervical emphysema, right pneumothorax and a small pneumopericardium. Initial laboratory testing showed normal blood levels of CRP and hemoglobin, indicating absence of existing infection or major blood loss. The patient was transferred to pediatric ICU. Continuous thoracic drainage was initiated by inserting a pigtail catheter into the right pleural gap and the patient was treated with broad spectrum antibiotics because of expected bacterial wound contamination. A second tracheoscopy was done (during temporary retraction of the tracheal tube) on day 3 (Fig. 1B), and a CT-chest-scan on day 4 (Fig. 1C). Both investigations revealed a bilateral tracheal laceration with scar tissue already sealing up the left tracheal defect, but air leakage through a newly discovered right tracheopleural fistula, thus maintaining a large pneumothorax with soft tissue emphysema on the right side. A tracheal tube with a cuff below the bilateral

* Corresponding author. Tel.: +49 2118118297; fax: +49 2118116539.
E-mail address: Mathis.Steindor@med.uni-duesseldorf.de (M. Steindor).

2213-5766/$ – see front matter © 2014 The Authors. Published by Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.epsc.2014.05.011

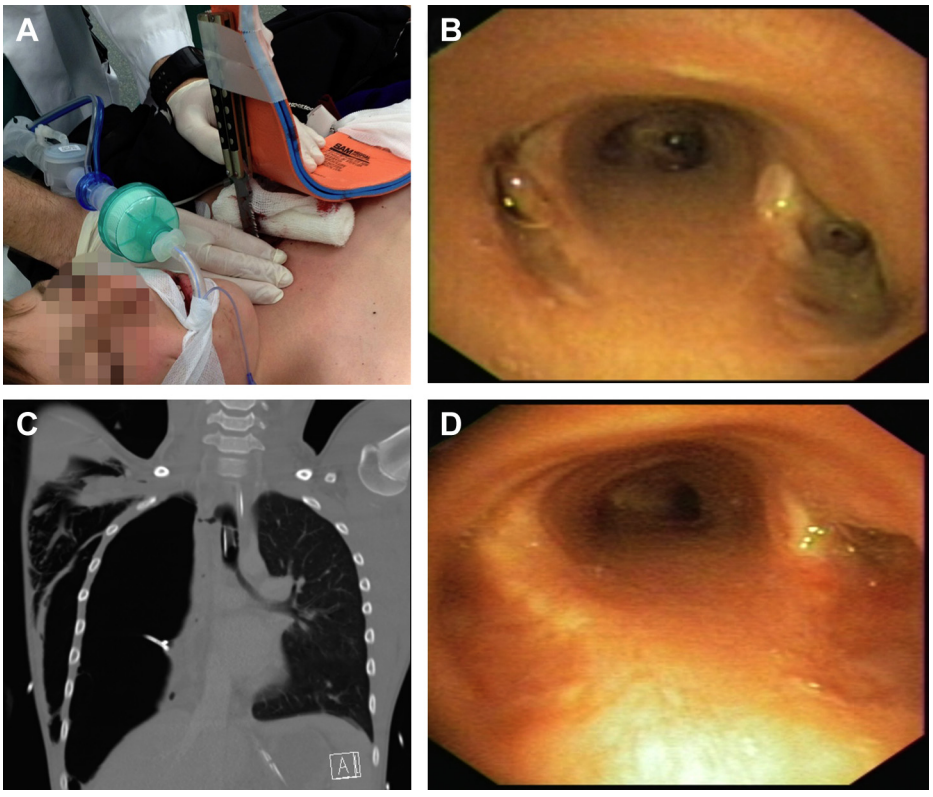

Fig. 1. Case 1: A, situation on admission; B, tracheoscopic view on day 3 showing bilateral tracheal wall defects; C, CT-chest-scan on day 4 showing tracheopleural fistula, pneumothorax and soft tissue emphysema; D, tracheoscopic view on day 7 showing sealed up bilateral tracheal wall defects.

tracheal lesions was inserted and a second pigtail catheter was placed into the right pleural gap. Serum-CRP concentrations increased and reached a maximum of 32.9 mg/dl at day 4 of admission. At that time the patient showed transient arterial hypotension with the necessity of catecholamine treatment for a few hours. Chest X-rays during the following days showed persistent pneumothorax and partly encapsulated pleural effusions. Thoracoscopic pleural decortication and targeted insertion of two 18-charriere drainages into the right pleural gap was performed on day 7 resulting in prompt complete expansion of the right lung. Tracheoscopy later that day showed that air leakage had stopped on both sides of the tracheal wall (Fig. 1D). The patient was successfully extubated on day 9 and was discharged on day 17. Unfortunately, the patient did not show up at several scheduled follow-up appointments.

2. Case 2

A 7-year old boy fell off his bike and presumably knocked his ventral neck on the handlebars. The exact mechanism of trauma is not known as the accident happened unobserved and the boy suffered from retrograde amnesia for the time of the trauma. He reached emergency room in stable cardiorespiratory state but with cervical soft tissue emphysema. Initial CT scan showed mediastinal emphysema but excluded pneumothorax and vertebral damage. Abdominal injuries were ruled out by ultrasound.

Shortly after administration to pediatric ICU during spontaneous breathing, a rapidly accreting subcutaneous emphysema was observed with expansion to face, thorax, abdomen, upper arms and legs. The patient felt sudden cervical pain. Immediate tracheoscopy showed a 3 cm laceration of the membranous trachea between the

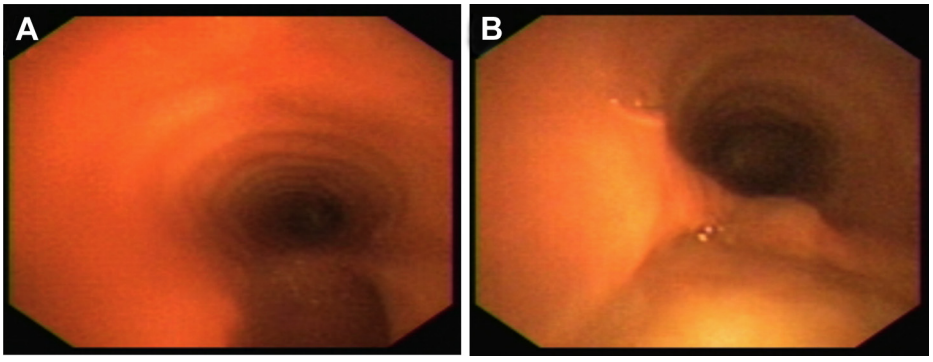

Fig. 2. Case 2: A, tracheoscopic view on admission showing large posterior tracheal wall defect; B, tracheoscopic view on day 4 showing sealed up tracheal wall defect.

upper and middle third of the tracheal wall (Fig. 2A). Endotracheal intubation was performed and the tube was cuffed distal to the laceration. Chest X-ray now showed bilateral pneumothorax with a maximum on the right side, so a drain was inserted into the right pleural gap. Thus, a complete expansion of the right lung and a stable respiratory state was reestablished. The left-sided pneumothorax resolved spontaneously over the following days. After 4 days of controlled ventilation, extubation was performed without complication. Tracheoscopy showed tightening scar tissue in the region of the laceration (Fig. 2B). The patient was discharged on day 12 with no residual impairments. In a three-month follow-up tracheoscopy no signs of stenosis or leakage were seen.

3. Discussion

These pediatric patients show two different kinds of severe tracheal lacerations. In case 1, a contaminating penetration trauma, mediastinitis and persistent leaking resulted in delayed healing. Even in the presence of leakage after one week, the tracheal wall defect sealed up spontaneously after complete lung expansion. In the course of the hospitalization, indication for surgical tracheal repair was frequently discussed among involved therapists. Decision against a surgical approach was made mainly because of contaminated trauma site and in respect of possible postoperative complications. However, we cannot exclude that a decision for surgical tracheal repair might have prevented the need for thoracoscopy and shortened the overall time on the ventilator. In case 2, a blunt neck trauma derived defect sealed up without complications. Both injuries were thus successfully treated conservatively and airway healing was monitored by repeated endoscopy. Favorable outcome of conservative treatment of tracheal wall injuries in children has been reported [6–8] though available recommendations in the literature would have excluded most reported cases from a conservative approach [9–12].

4. Conclusion

Our reports show that conservative treatment of traumatic tracheal injuries must be taken into consideration and is feasible in pediatric patients. We were able to demonstrate that spontaneous tracheal healing is possible and likely, when adequate ventilation is achievable by an endotracheal tube bridging tracheal defects without significant air leakage. In those cases we would prefer a conservative approach over surgical tracheal repair. However, guidelines for treatment of tracheal injuries are desirable but not derivable from currently available data. Any decision for an either surgical or conservative approach must be based on diligent interpretation of clinical, radiological and endoscopic findings and has to be reevaluated and adjusted to the course and progress of healing which is monitored by repeated endoscopy.

References

[1] Ecker RR, Libertini R, Rea WJ, Sugg WL, Webb WR. Injuries of the trachea and bronchi. Ann Thorac Surg 1971;11:289–98.
[2] Lyons JD, Feliciano DV, Wyrzykowski AD, Rozycki GS. Modern management of penetrating tracheal injuries. Am Surg 2013;79:188–93.
[3] d'Odemont JP, Pringot J, Goncette L, Goenen M, Rodenstein DO. Spontaneous favorable outcome of tracheal laceration. Chest 1991;99:1290–2.
[4] Marquette CH, Bocquillon N, Roumilhac D, Neviere R, Mathieu D, Ramon P. Conservative treatment of tracheal rupture. J Thorac Cardiovasc Surg 1999; 117:399–401.
[5] Meyer M. Latrogenic tracheobronchial lesions – a report on 13 cases. Thorac Cardiovasc Surg 2001;49:115–9.
[6] Beiderlinden M, Adamzik M, Peters J. Conservative treatment of tracheal injuries. Anesth Analg 2005;100:210–4.
[7] Cunningham LC, Jatana KR, Grischkan JM. Conservative management of iatrogenic membranous tracheal wall injury: a discussion of 2 successful pediatric cases. JAMA Otolaryngol Head Neck Surg 2013;139:405–10.
[8] Lin HC, Yen TA, Wu ET, Wang CC. Conservative management of a 13-year-old boy with postintubation tracheal injury. J Formos Med Assoc 2013 Jun 17. http://dx.doi.org/10.1016/j.jfma.2013.05.001. pii: S0929-6646(13)00168-X [Epub ahead of print].
[9] Chang CY, Cheng SL, Chang SC. Conservative treatment of severe tracheal laceration after endotracheal intubation. Respir Care 2011;56:861–2.
[10] Gabor S, Renner H, Pinter H, Sankin O, Maier A, Tomaselli F, et al. Indications for surgery in tracheobronchial ruptures. Eur J Cardiothorac Surg 2001;20: 399–404.
[11] Hofmann HS, Rettig G, Radke J, Neef H, Silber RE. Iatrogenic ruptures of the tracheobronchial tree. Eur J Cardiothorac Surg 2002;21:649–52.
[12] Mussi A, Ambrogi MC, Ribechini A, Lucchi M, Menoni F, Angeletti CA. Acute major airway injuries: clinical features and management. Eur J Cardiothorac Surg 2001;20:46–51. discussion 51–42.